

front, with a complete marginal stria; the metasternum also has a somewhat similar and independent stria, but the stria is without the sinuosity; the first abdominal segment has a well-marked lateral stria; the anterior tibiæ are armed with two strong teeth, the apical one bifid, and three small ones behind.

Hister meridanus may be associated with *H. nodatus* and *H. gibberosus*, Lew.

Hab. Yucatan (*Donckier*). Two examples.

[To be continued.]

XXX.—*On the Absence of Regeneration in the Posterior Limbs of the Orthoptera saltatoria and its probable Causes.*
By EDMOND BORDAGE*.

UP to the present opinions have been divided with regard to the regeneration of the posterior limbs of the Orthoptera saltatoria. Among naturalists denying the possibility of such regeneration I may mention Heineken, Graber, Durieu, Frédéricq, Contejean, Werner, and Peyerimhoff. Among those who admit it I may mention Professor Griffini (of Turin).

In the attempt to settle this debated question I undertook a very large series of experiments upon representatives of three families of Orthoptera saltatoria, choosing for my subjects *Phylloptera laurifolia* and *Conocephalus differens* among the Locustidæ, *Acridium rubellum* among the Acrididæ, and *Gryllus capensis* among the Gryllidæ.

The experiments in question have led me to the conclusion that regeneration of the jumping-legs does not take place. I have, in fact, not been able to find the least trace of regenerative power.

Here is a fact which at first sight seems to be contrary to the law of Lessona, for the jumping-legs are those which are most exposed to injury by enemies, and can be detached from the body by self-mutilation as a means of escape, as well as *in casting the skin* [*exuvial self-mutilation*]. We shall see, however, that this case by no means forms an exception to the law of the celebrated Italian biologist.

I have in fact been able to note with regard to larvæ kept in captivity how difficult the moults became after the loss of

* Translated from 'Comptes Rendus,' cxxix. (July 10, 1899) pp. 120-123, by Wilfred Mark Webb, F.L.S. From a separate impression communicated by the Author.

jumping-legs. Difficulties presented themselves especially at the last moult, when the Orthopteron must free his wings from their covering. His big hind legs would have allowed him to brace himself up to his work more effectively, giving him a valuable means of support at the time when he had to make his laborious efforts to free himself from his chitinous envelope. Almost all die before having rid themselves of this wrapper. Among the rare survivors, with one or two exceptions, I have only seen completely disabled insects with wings all crumpled, and sometimes even atrophied, creeping along with difficulty. These points were specially striking in *Phylloptera laurifolia*.

Supposing for a moment that instead of being safe from their numerous enemies, as they were in the cages where I had reared them, these damaged Orthoptera had been left to themselves. It now becomes evident that the few examples which had managed to survive the dangers presented by the process of moulting would have, in spite of this fact, but little chance of reaching the perfect state. Let us admit even that some among them, having escaped all their enemies, had attained their complete development after having undergone the last and most formidable moult. It still seems impossible to me that these insects would be able to pair. In the first place, whatever their sex, the absence of their big legs would completely prohibit it; in the second place, granting once more that it was not found to be an insurmountable obstacle, it is only right to admit that the mutilated insects in question would be left on one side by reason of the sexual selection which appears to have been clearly proved among Orthoptera saltatoria*. Finally, among certain of the Orthoptera with fighting tendencies, such as the crickets, which not only quarrel over the females, but engage in mortal combats for the possession of the hole which serves them for a dwelling,

* See Charles Darwin, 'The Descent of Man and Sexual Selection' (French edition, 1891, pp. 311-318). Among the most interesting cases quoted in this book occurs that of *Pachytylus migratorius*. Körte has pointed out the choice exercised by the female with respect to the male. The male of this species when paired with a female shows his anger by stridulations when another male comes near. If the musical apparatus plays a part in sexual selection, Orthoptera saltatoria deprived of their jumping-legs, and which in spite of this have reached the perfect state, must be in a condition of great inferiority when compared with their rivals, for, as I have already remarked, their wings being quite bruised and sometimes even atrophied, their musical apparatus is incapable of acting. In the Acrididæ especially the emission of musical notes is rendered quite impossible, as the femora of the jumping-legs take part in their production.

the absence of hind legs would put them to a very great disadvantage.

There is then every reason to allow that these various causes prevent mutilated individuals among the *Orthoptera saltatoria* from taking part in the reproduction of the species. This evidently explains the absence of the power of regeneration.

In several species of *Orthoptera saltatoria* the trochanter of the hind limbs is quite withdrawn (*telescoped*, to use the picturesque expression of Messrs. Sharp and Brindley) into the interior of the coxa. I thought at first that this arrangement might perhaps prevent regeneration. I found afterwards that this could not be, for there is the same absence of regeneration in insects which do not show it.

The cases of inequality in the size of the jumping-legs recorded by Griffini in *Pristes tuberosus* and in species belonging to the genera *Ædipoda* and *Gomphocerus* appear to me to be due to atrophy and not to regeneration*. I have been able to find analogous peculiarities in *Phylloptera laurifolia*. Sometimes immediately after a moult an arrest of the growth takes place with regard to one of the two jumping-legs, which up to that time had been perfectly equal. I have even noticed the same thing in the case of the wings in the same species of locust. When this insect undergoes its last moult, the wings on one side of the body develop completely, while those on the opposite side remain rudimentary, their size not exceeding that of the wing-coverings of the nymph.

I am, however, constrained to add that there is good reason for Professor Griffini's belief that regeneration of the two anterior pairs of limbs may take place in *Orthoptera saltatoria*, judging from an observation made on *Platyphyllum Regimbarti*.

In a forthcoming communication I propose to show the truth of Griffini's hypothesis and to prove the possibility of the regeneration of the limbs in question as well as the regeneration of the tarsi in the three pairs of limbs in the *Orthoptera saltatoria*.

The determination of the phenomenon of exuvial self-mutilation furnishes a complete explanation of the facts in accordance with the law of Lessona.

* Griffini states elsewhere that he never found any traces of regeneration in the insects which he reared in captivity.